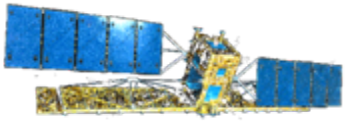
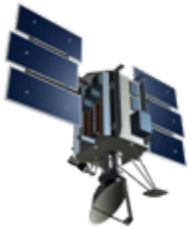
U.S National/Naval Ice Center:
Operational Changes in an Ice-Diminishing Area of Responsibility





CDR Timothy B. Smith
Director, U.S. National Ice Center
Commanding Officer, Naval Ice Center
16 July 2013

USN

USCG

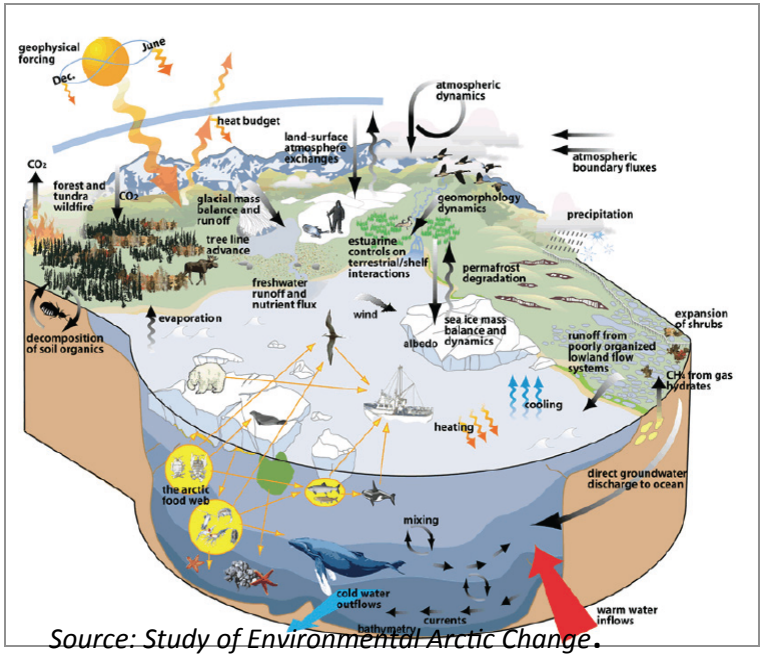
NOAA

Arctic Environment

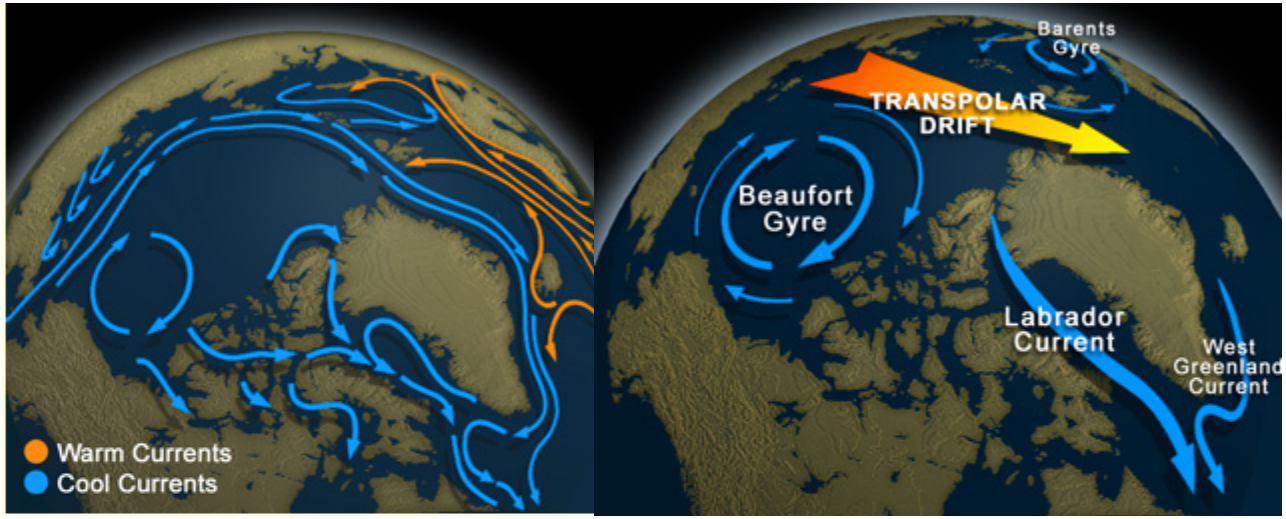
Sea ice influences change on numerous scales:

- Influences planetary heat budget
- Interacts with the oceanic and atmospheric circulation
- Interacts with the terrestrial environment.

Sea ice part of global climate system



Source: Study of Environmental Arctic Change.



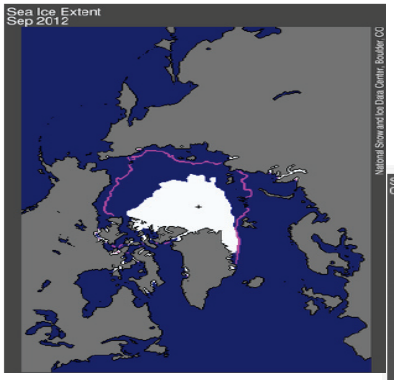
Source: Arctic Ocean Web.

Annual Sea Ice Extent

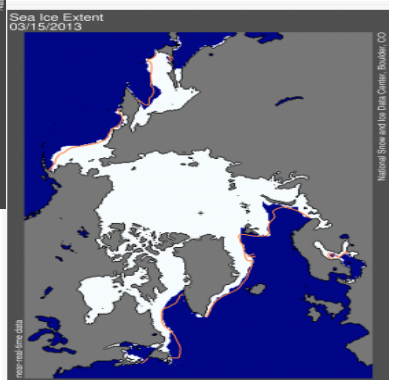
Continued decreased ice extent

Global climate system

Predictive capability inadequate

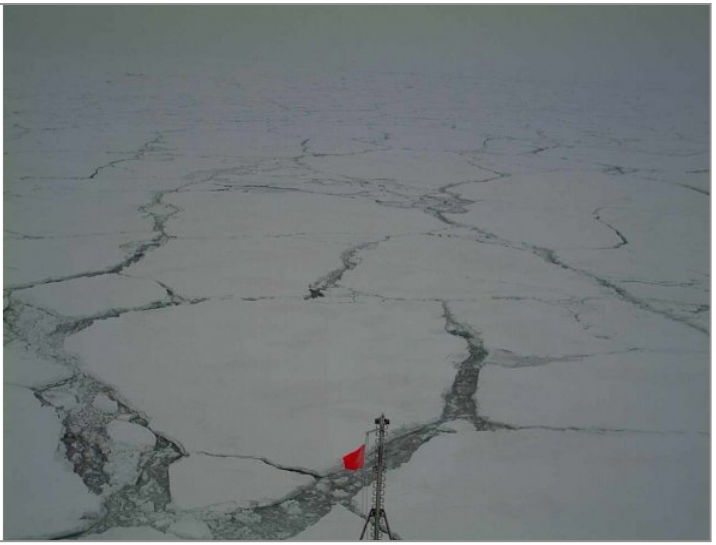


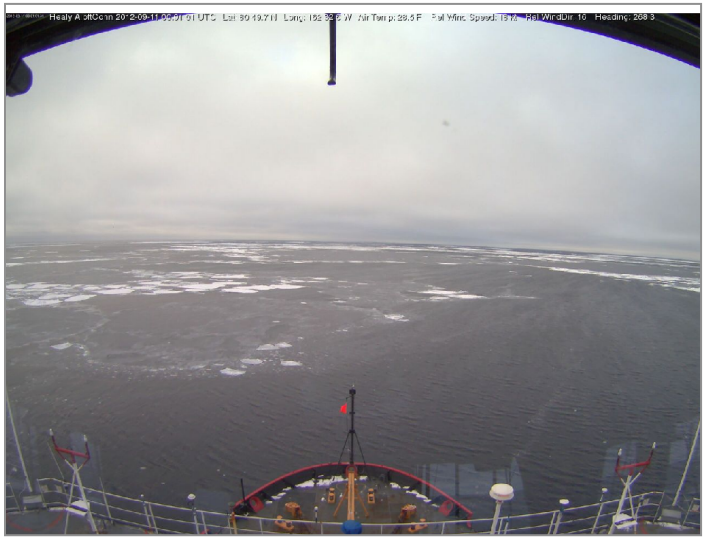
Minimum Sea Ice Extent
Sept 2012, 3.6 mil sq km



Maximum Sea Ice Extent March 2013
15.13mil sq km

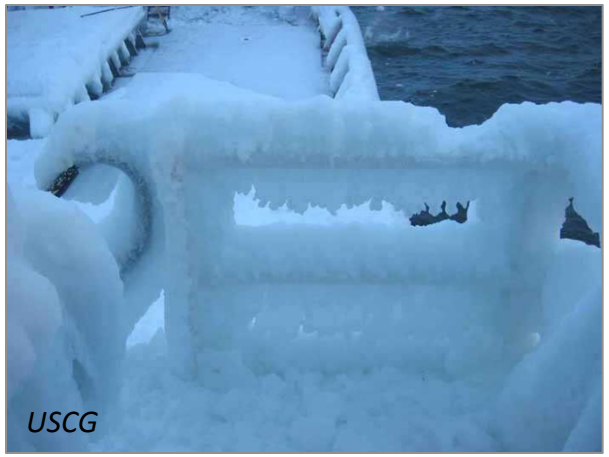
Healy Cam Sep 2006-Sep 2012





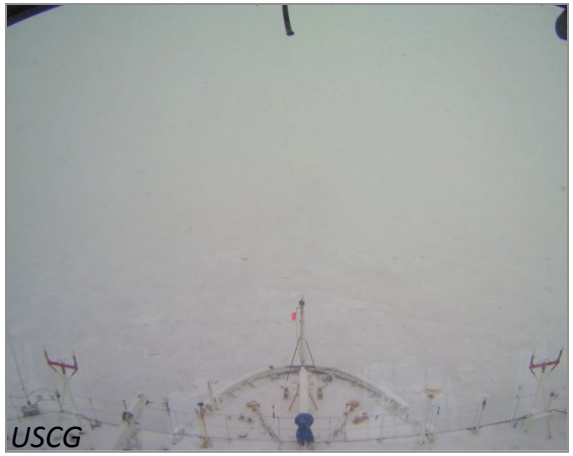
Impacts on Maritime Environment

Arctic boundary layer warmer and wetter
Cloudiness increase and remain longer
Fast changing weather conditions
Number days with fog/limited visibility
Increase mixed phase precipitation –
    increases vessel and aircraft icing
More open water – larger fetch areas, larger waves
Ice embedded in rough seas


USCG


USCG


USCG


USCG

Challenges to Military Operations

Air Ops Challenges
Space Support Challenges
Undersea Ops Challenges
Land Ops Challenges
Sea-surface Ops Challenges

Limitations of Analysis and Forecasting

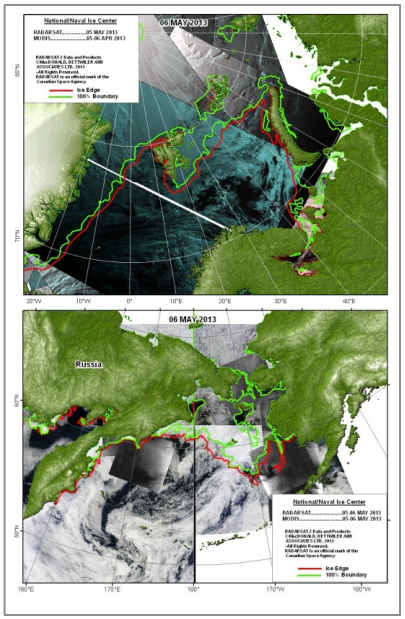
Rush to improve ability to predict characteristics of sea ice cover in order to better model the future of ice cover.

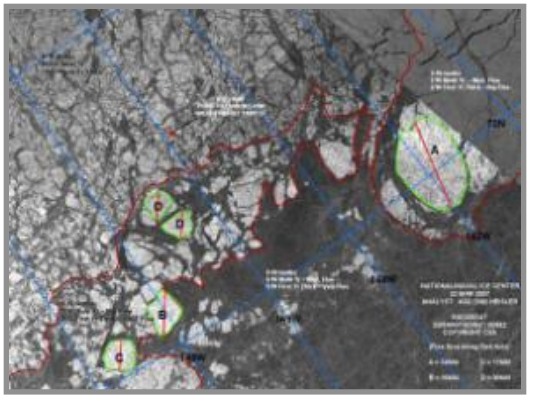
Limitations to seasonal scale sea ice forecasting :

(1) high variability in atmospheric and oceanic influence
(2) observations for initialization and validation have limited coverage and/or high uncertainties
(3) limitations of current model capabilities
(4) inherent limitations in sea ice predictability
(5) an Arctic system changing in ways without recent historical precedent.

Limitations of Analysis and Forecasting

- Remote sensing currently providing one of the best opportunities for year round monitoring of the Arctic sea ice conditions.
- Provides one method to collect critical parameters needed to assess climate change.
- In-situ observation of critical parameters are limited by distance, harsh environment, darkness, no available resources, and lack of infra-structure and platforms of opportunity.
- Remote sensing and observation communities collaboration with the modeling communities are essential.





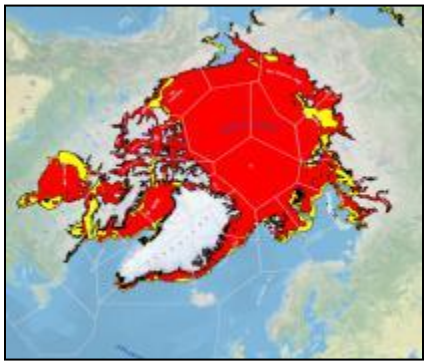
All parameters require improved monitoring, prediction, and communication of sea ice conditions.

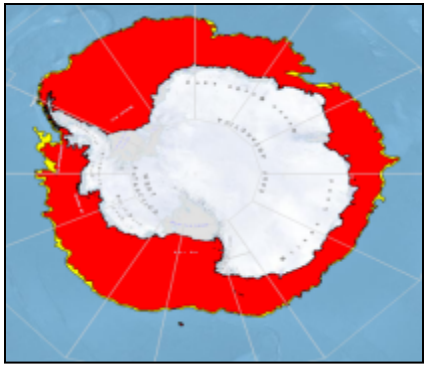
Current Ice Services in the U.S.

US National Ice Center	NWS Alaska Sea Ice Desk	US National Snow and Ice Data Center	International Ice Patrol
Global	US Alaska Waterways	National Data Archive	NE Atlantic Waters
US Navy	US Government	US Navy	US Coast Guard
US Coast Guard	US Coast Guard	US Coast Guard	Merchant Shipping
Government Agencies	General Public	Government Agencies	
General Public	Local Fishermen	General Public	
Education Institutions	Education Institutions	Education Institutions	
OPERATIONAL	**REGIONAL**	**ARCHIVE**	**ICEBERG DETECTION**

U.S. National/Naval Ice Center

- A multi-agency operational center operated by the United States Navy, National Oceanic and Atmospheric Administration, and United States Coast Guard.
- Located in Suitland, Maryland and employs ~40 military and civilian personnel.
- Over 140 National and International Customers, including SUBFOR, ONI, USCG, NOAA, NWS, NSF, MSC, and NASA.
- GLOBAL sea ice analysis and forecasting.





Coverage 20.6 Million Square Miles – Arctic, Antarctic, and Great Lakes

Mission: Provide global ice and snow (including the Great Lakes and the Chesapeake and Delaware Bay systems) analysis and forecasting services for the maximum benefit of United States government interests.

U.S. National/Naval Ice Center

Operational Center

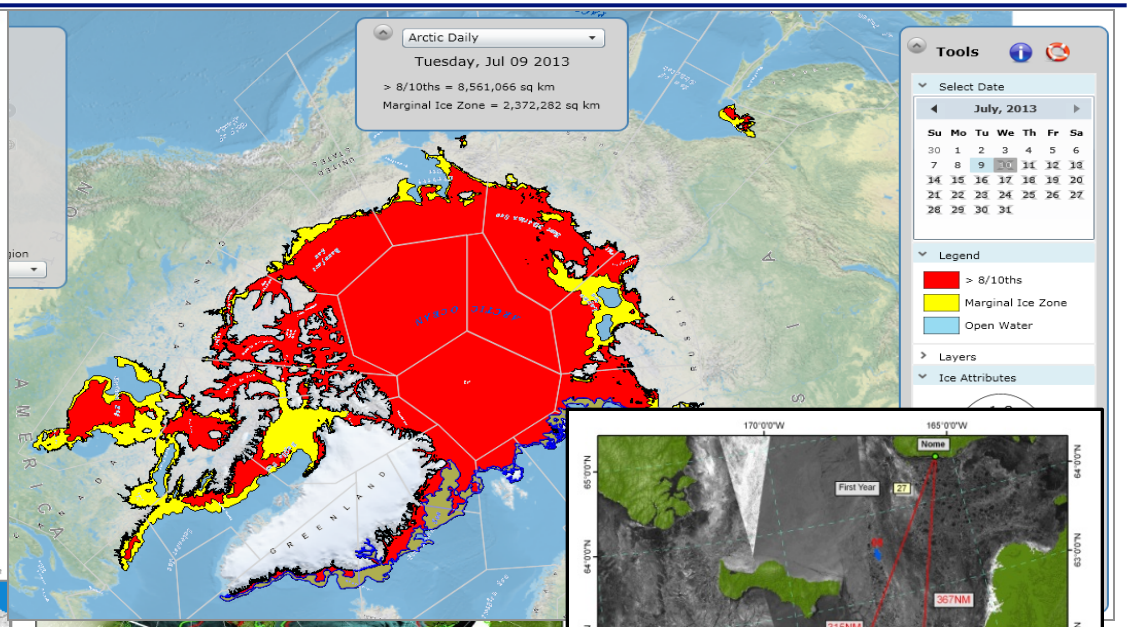
Updated imagery sources for real time/near real time analysis

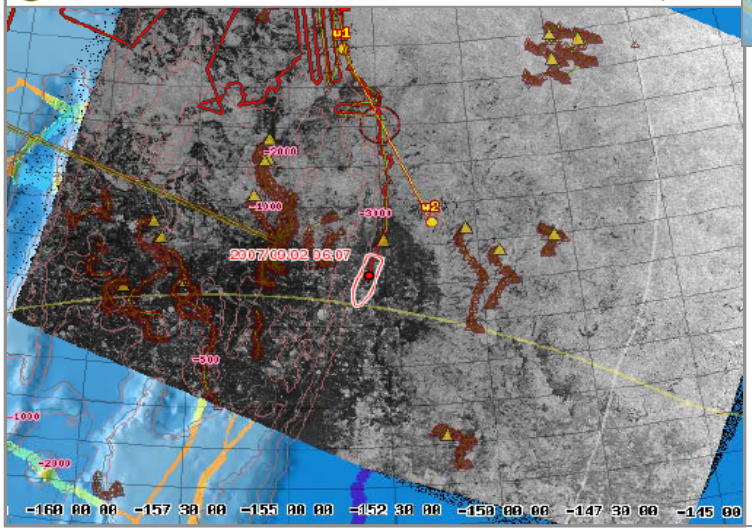
Geodatabase of selected sea ice parameters enables sharing data with many partners

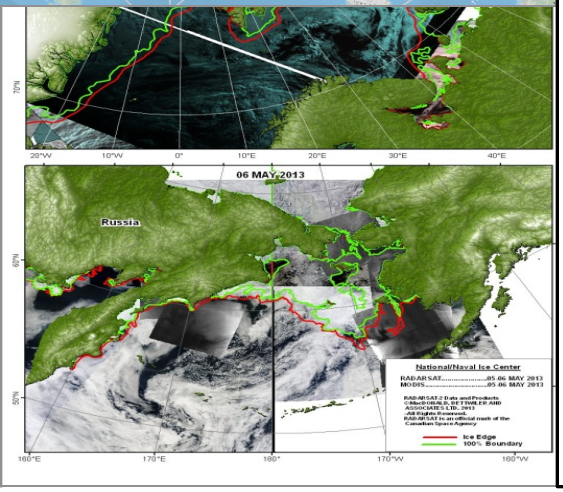
International collaboration with ice services of the world

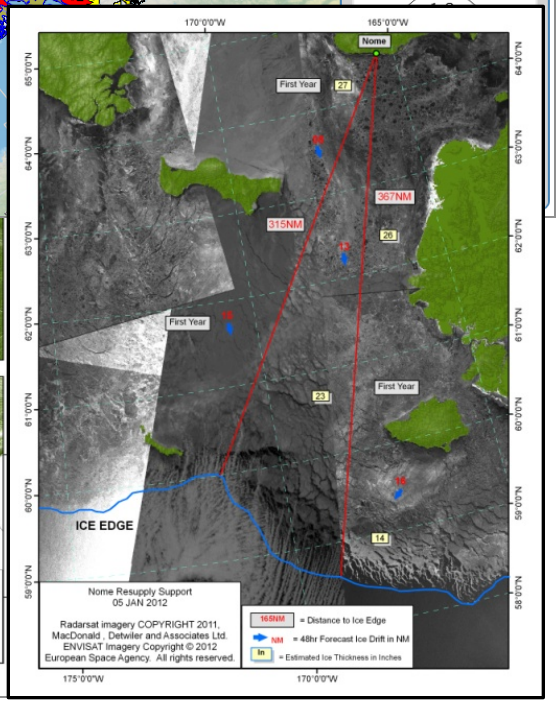
U.S. National Ice Center	U.S. Naval Ice Center	
NWS	SUBFOR	NMFC Norfolk and San Diego
NCEP	Arctic Submarine Lab	Naval Academy
GLERL	DEVRON 5 and 12	Military Sealift Command
IMS Product	ONI	British Military
Public Webpage	NGA	Canadian Military
NOAA Research Vessels	NAVOCEANO	Intel Community
NOAA NASA	NORAD NORTHCOM	Canadian Ice Service
Ad-Hoc Requests	United States Coast Guard	Ad-Hoc Requests

U.S. National/Naval Ice Center









"The environmental aspects cannot be overlooked"…Maj Gen Kee, Dep Dir Military Affairs (W Hemisphere), Strategic Plans and Policy, Joint Staff Pentagon.

Collaboration – Data Sharing

- Improved information and data management
- Standard formats of data containing identified parameters needed for modeling and operational communities
- Distributed databases that appear uniform and singular to the user
- Leverage existing infrastructure
- Facilitate ease of information retrieval
- Long term and stable support for database
- Agreed upon metadata standards

North American Ice Service

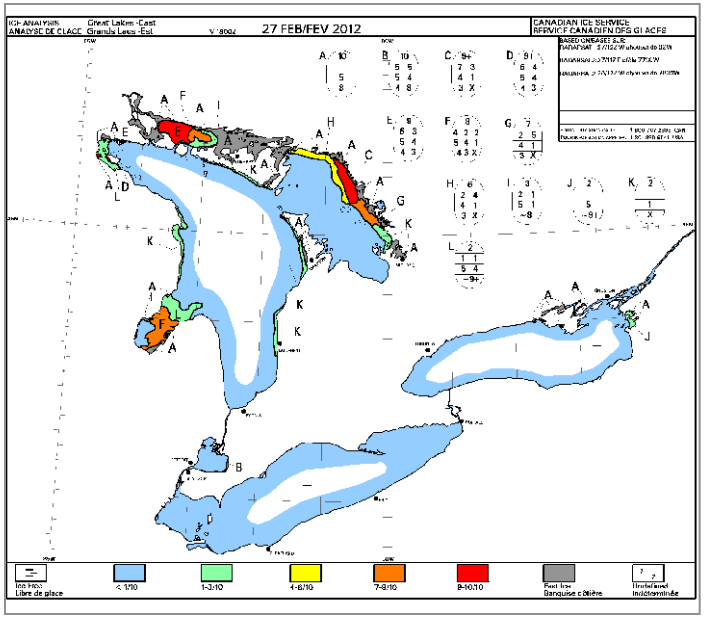
US National Ice Center
Canadian Ice Service
USCG International Ice Patrol

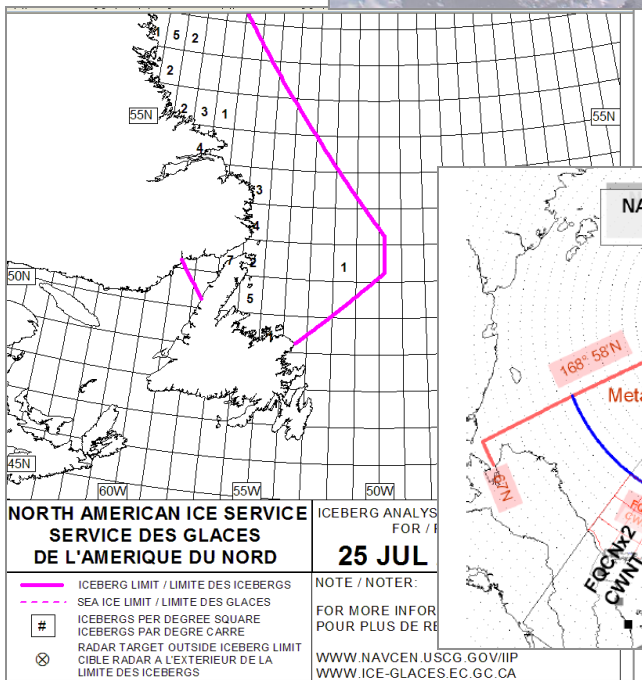
….. to leverage the strengths of the Canadian Ice Service, US National Ice Center, and the International Ice Patrol to monitor and provide the highest quality, timely and accurate ice analysis, in order to meet the needs of the maritime interests of the United States and Canadian governments

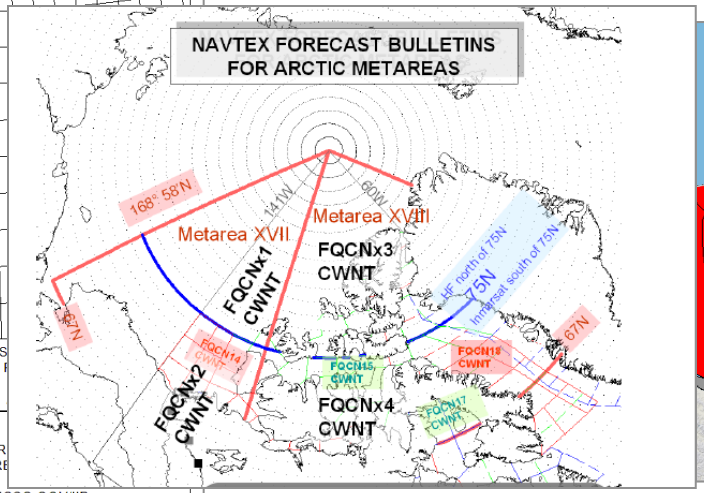
Transform individual organizational strengths into a unified source of ice information…

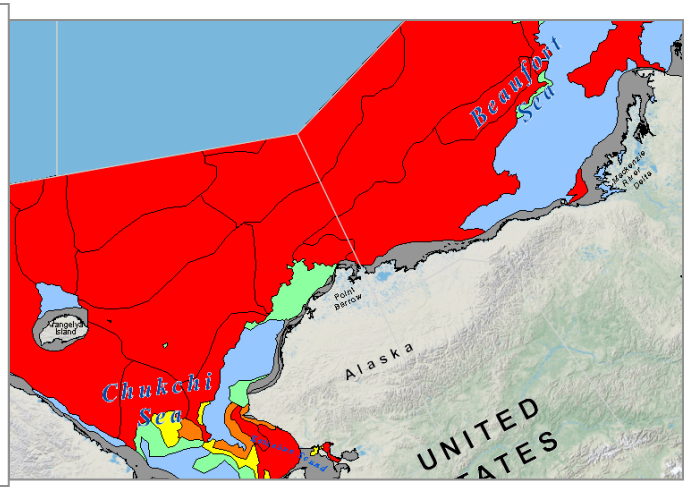
SHARED RESOURCES	VALUE OF COLLABORATION
Synthetic Aperture Radar	Imagery Savings ~$1.6m/yr
Manhours	Manhour Savings (NIC)~20K/yr
Local Expertise	Local Expertise
Aerial Recon Icebergs	Flexibility to persue new projects
Iceberg Charts	Support Joint Missions
	Contingency Critical Products

North American Ice Service









International Ice Charting Working Group

US National Ice Center
Canadian Ice Service
USCG International Ice Patrol
Danish Meteorological Institute
Federal Maritime and Hydrographic Agency of Germany
Finnish Meteorological Institute
Icelandic Meteorological Office
Hydrographical Department, Maritime Safety Agency, Japan
North American Ice Service
Norwegian Meteorological Institute
Russian Federation Arctic and Antarctic Research Institute
Swedish Meteorological and Hydrological Institute

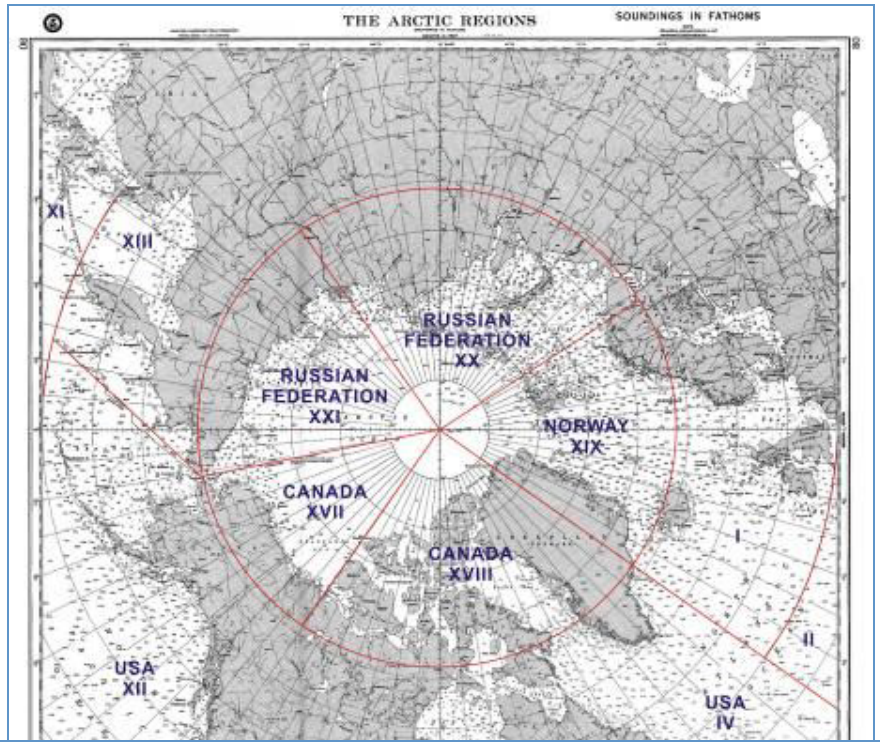
Promote cooperation between the world's ice centers on all matters concerning sea ice and icebergs.

International Ice Charting Working Group

SHARED RESOURCES
Sea Ice Analysis GIS Files
Manhours
Local Expertise
Ice Reports
Imagery Savings

ICE ANALYSIS
Baltic Sea
NATIONAL/NAVAL ICE CENTER
Analysis Week 14 - 18 Feb 2011

Data Sources	Date
MODIS	13 - 14 Feb
ENVISAT/GMM	12 - 14 Feb
SMHI	14 Feb



ICE ANALYSIS
Baffin Bay
NATIONAL/NAVAL ICE CENTER
Analysis Week 24 - 28 Sep 2012

Data Sources	Date
MODIS	24 - 26 Sep
OLS	24 - 25 Sep
CIS	24 Sep

International Arctic Buoy Program

United States
Norway
Germany
Russia
Canada
China
France
Japan
Scotland
Switzerland

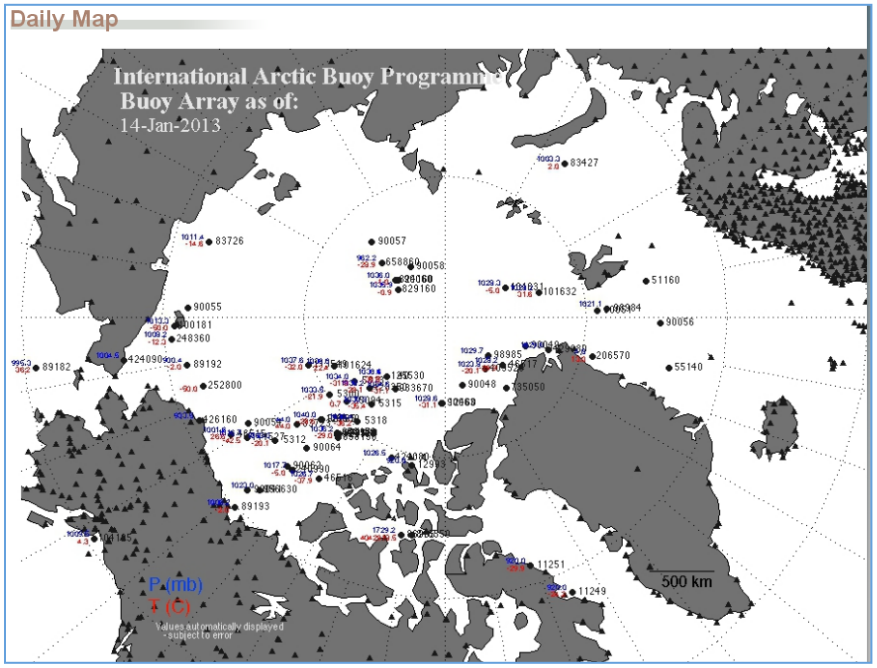
The U.S. contributions to the IABP are coordinated through the U.S. Interagency Buoy Program (USIABP), which is managed by the US National Ice Center, and the Polar Science Center, and represent several U.S. agencies, including the International Arctic Research Center, the National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, the National Science Foundation, the Naval Oceanographic Office, the Office of Naval Research, and the US Coast Guard.

Global participants working together to maintain a network of drifting buoys in the Arctic Ocean to provide real-time operational requirements and research purposes…..

International Arctic Buoy Program

SHARED RESOURCES

- Science and Research
- Manpower
- Platforms of Opportunity
- Financial Cost Sharing
- Imagery Savings



Crew members and scientists from the US Coast Guard icebreaker Healy haul a buoy across the sea ice during a deployment. In the lead, BM3 Yeckley is on bear watch, followed by SN Hafner the rescue swimmer, Dr. Pablo Clemente-Colón (pulling), and Dr. Dale Chayes steadying the sled..

© McKenzie Funk

http://iabp.apl.washington.edu

JCOMM Expert Team on Sea Ice

Formal coordination of sea ice activities on the level of WMO/IOC; closed membership (from various international ice centers) defined at JCOMM sessions; under WMO standards; formal linkages with IHO/IMO (via Secretariat); finalize and provide Technical direction to WMO Secretariat.

SHARED RESOURCES
Global Standardization
Subject Matter Expertise
Financial Resources – manpower
WMO/IOC representation

- Collaboration Efforts:
- Sea Ice Analysis Training via International Ice Analyst Workshops
- Supporting Issues for GMDSS in Arctic
- Catalogue Met-Ocean Object Class for ENC and e-navigation
- Ice Information in ENC's
- Update sea ice standards
- Global Sea Ice Digital Data Bank

Challenges with Collaboration

- Distance/Language Barrier
- Areas of interest
- Analysis methodologies
- Pace of implementation
- Different goals and priorities
- Different customer base and customer requirement
- IT differences
- Manpower – allowing time to effectively coordinate

Questions?